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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PR 9914 for a patent by J BERTONY PTY LIMITED as filed on 10 January 2002.

COMMONWEALTH OF AUSTRALIA
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Thirtieth day of September 2002

LEANNE MYNOTT
MANAGER EXAMINATION SUPPORT
AND SALES

J BERTONY PTY LIMITED

AUSTRALIA
Patents Act 1990

PROVISIONAL SPECIFICATION FOR THE INVENTION ENTITLED:

A TURBINE

The invention is described in the following statement:-

3252A

The present invention relates to turbines and, in particular, to turbines in which the axis of rotation is substantially perpendicular to the direction of fluid flow. The fluid can be either a gas, such as wind, or a liquid, such as water.

Turbines are presently used as wind generators to generate electricity in an "ecologically friendly" manner. Typically such wind generators are horizontal axis devices bearing 2 or 3 propellers similar in appearance to aircraft propellers. The electric generator, gearbox and ancillary equipment are mounted in line with the propellers and turn with the wind. This requires expensive lifting equipment and expensive masts or towers. Consequently, these designs, whilst being commercially successful, are capital intensive.

Vertical axis wind generators are known. This basic design enables the generator, gearbox and ancillary equipment to be placed at ground level. One design of a vertical axis turbine uses two thin curved blades and is referred to as an "egg beater". In general, vertical axis wind turbines have not been commercially successful.

The object of the present invention is to provide a turbine which can be used as a vertical axis wind generator and thereby provide an alternative turbine.

In accordance with the present invention there is described a turbine for rotation about a longitudinal axis substantially perpendical to the direction of fluid flow, said turbine comprising at least one longitudinally extending blade which increases in axial cross-sectional width along the axis, each blade including a tip strip rearwardly inclined relative to the direction of rotation, the leading surface of said blade diverting fluid flow impinging thereon to generate a zone of reduced fluid pressure acting thereon and the trailing surface of said blade catching fluid flow impinging thereon to generate a zone of increased fluid pressure acting thereon

A preferred embodiment of the present invention will now be described with reference to the drawings in which:

Fig. 1 is a perspective view of the turbine vertically mounted for wind powered operation,

Fig. 2 is a horizontal cross-sectional view taken along the line II-III of Fig. 1,

Fig. 3 is a horizontal cross-sectional view taken along the line III-III of Fig. 1,

Fig. 4 is a side elevational view of the turbine of Fig. 1,

Fig. 5 is a sequence of views utilising Figs. 2 and 3 and showing the rotational sequence,

Fig. 6 is a schematic plan view showing the preferred dimensional relationships,

Fig. 7 is a side elevation showing the preferred dimensional relationships,

Fig. 8 is a inverted plan view showing the preferred dimensional relationships, and

Fig. 9 is a fragmentary plan view showing various preferred angular relationships.

As seen in Figs. 1-4, the turbine 1 is mounted about a vertical axis and is provided with a stationary base 3 and a conical cap 4 which rotates with the turbine 1. The turbine 1 has three identical blades 5 which, as best seen in Figs. 2 and 3, are equally set at 120° to each other about the axis 2. Each blade 5 is provided with a tip strip 7 which extends from top to bottom of the blade 5 and has a substantially constant width.

The blades 5 are helically arranged with respect to the axis 2 and are swept rearwardly with respect to the intended clockwise direction of rotation (as seen in Figs. 2, 3 and 5). The cross-sectional thickness of the blades 5 increases from top to bottom, however, in contrast the cross-sectional thickness of the tip strips 7 is substantially constant. The pitch of the blades is 90°.

As seen in Fig. 2 each blade 5 extends from a central drum 8 which is cylindrical and co-axial with the axis 2. When viewed in plan as seen in Fig. 2, the base of the tip strip 7 is tangential to the drum 8 as indicated by the dashed lines in Fig. 2. As also seen in Fig. 2, the blade leading surface 10 at the tip of the bade 5 is tangential to the drum 8. Similarly, as seen in Fig. 3 the leading surface 10 is also tangential to the drum 8 at the bottom of the blade 5.

Each blade 5 also has a trailing surface 11 and the increasing angle between the surfaces 10, 11 as one moves from top to bottom of the blade 5 is clearly apparent from Figs. 2

and 3. This angle varies over the full blade length and results in a differential air flow velocity between the two surfaces 10, 11.

The operation of the turbine will now be described by analogy to the operation of the sails of a yacht. With reference to Fig. 5 if it is assumed that the wind direction is from the top of the page towards the bottom, then at the 0° position blade C is catching the wind in the manner of a main sail with the yacht sailing before the wind. That is wind pressure develops on the trailing surface 11 of blade C. The blade C thus generates a torque to cause clockwise rotation.

In addition, the blade A is functioning as a jib or headsail. The wind is blowing over the curved leading blade surface 10 and so has a relatively low pressure acting on surface 10. Conversely, the air adjacent surface 11 of blade A is turbulent and thus has a relatively high pressure. Therefore there is a pressure difference across blade A and a clockwise rotation inducing torque is created.

Finally, for the 0° position indicated in Fig. 5, blade C is pointing substantially directly into the wind and thus generates little or no torque.

As the turbine turns to the 30° position illustrated in Fig. 5, blade B beings to function as a sail sailing before the wind, blade C begins to enter the lee caused by the drum 8, and the blade A continues to function as a headsail.

At the 60° position illustrated in Fig. 5, blades B and A are essentially functioning as for 30° but blade C is now fully in the lee caused by drum 8 and is thus not contributing any torque.

At the 90° position illustrated in Fig. 5, blade A's contribution is falling as it begins to point higher and higher into the wind, blade B's contribution is at or near a maximum, whilst blade C's contribution into the wind is only just commencing.

Finally, at the 120° position illustrated in Fig. 5, the same relationship to the wind as in 0° has been reached but with different blades. That is blade A has the same relationship to the wind as that formerly occupied by blade B, and so on. The generation of torque is thus analogous to that generated by a two stroke engine of three cylinders.

It will be apparent from Fig. 5, that the choice of wind direction is entirely arbitrary. Thus the turbine generates torque irrespective of the wind direction. Furthermore, horizontal axis wind turbines must be turned to face the wind and thus are disadvantageous in conditions of rapid changes in wind direction as occur in light and "flukey" winds. A vertical axis wind generator is not so disadvantaged.

Figs. 6-9 provide the preferred relative dimensions of the turbine expressed in terms of the drum diameter DX. Thus the apparatus can clearly be scaled to different sizes without difficulty.

The preferred mounting and power transmission arrangement is a central shaft co-axial with the drum and rotating therewith. Surrounding the shaft and generally co-axial therewith but inside the drum is a stationary column or tower. At the top of the tower is a bearing to support the cone, and the upper portions of the drum, blades and shaft. Guide rollers positioned between the support column and the interior of the drum rotatably support the lower portions of the drum and blades. The lower end of the shaft is directly coupled to a gear box and/or an electric generator which are stationary. The blades 5 and 8 can be inexpensively constructed from light weight sheet metal.

The foregoing describes only one embodiment of the present invention and modifications, obvious to those skilled in the art can be made thereto without departing from the present invention. For example, the turbine can be inverted and placed in a tidal flow of water in order to generate power.

The term "comprising" (and its grammatical variations) as used herein is used in the inclusive sense of "including" or "having" and not in the exclusive sense of "consisting only of".

THE ASPECTS OF THE INVENTION

The following paragraphs define some aspects of the present invention:

1. A turbine for rotation about a longitudinal axis substantially perpendical to the direction of fluid flow, said turbine comprising at least one longitudinally extending blade which increases in axial cross-sectional width along the axis, each blade including a tip strip rearwardly inclined relative to the direction of rotation, the leading surface of said blade diverting fluid flow impinging thereon to generate a zone of reduced fluid pressure acting thereon and the trailing surface of said blade catching fluid flow impinging thereon to generate a zone of increased fluid pressure acting thereon.
2. The turbine as defined in paragraph 1, and having three blades arranged equally at 120° about said axis.
3. The turbine as defined in paragraph 2 wherein the pitch of said blades is approximately 90°.
4. The turbine as defined in any one of paragraphs 1-3 and mounted for rotation by wind.
5. The turbine as defined in any one of paragraphs 1-3 and mounted for rotation by liquid.
6. The turbine as defined in any one of paragraphs 1-5 and coupled to an electric generator.
7. The turbine substantially as herein described with reference to the drawings.

Dated this 10th day of January 2002.

J BERTONY PTY LIMITED

HODGKINSON OLD McINNES
Patent Attorneys for the Applicant

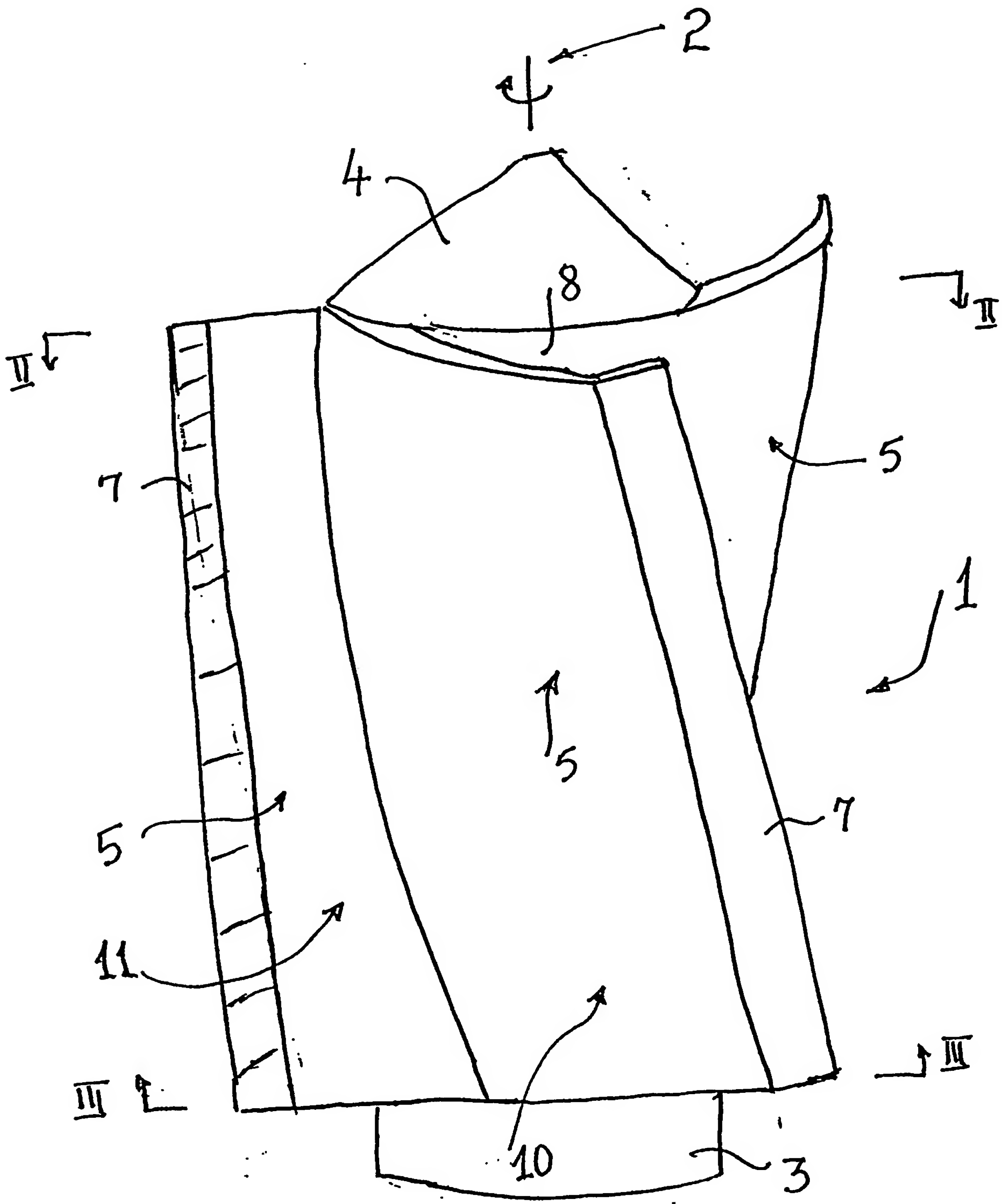


Fig. 1

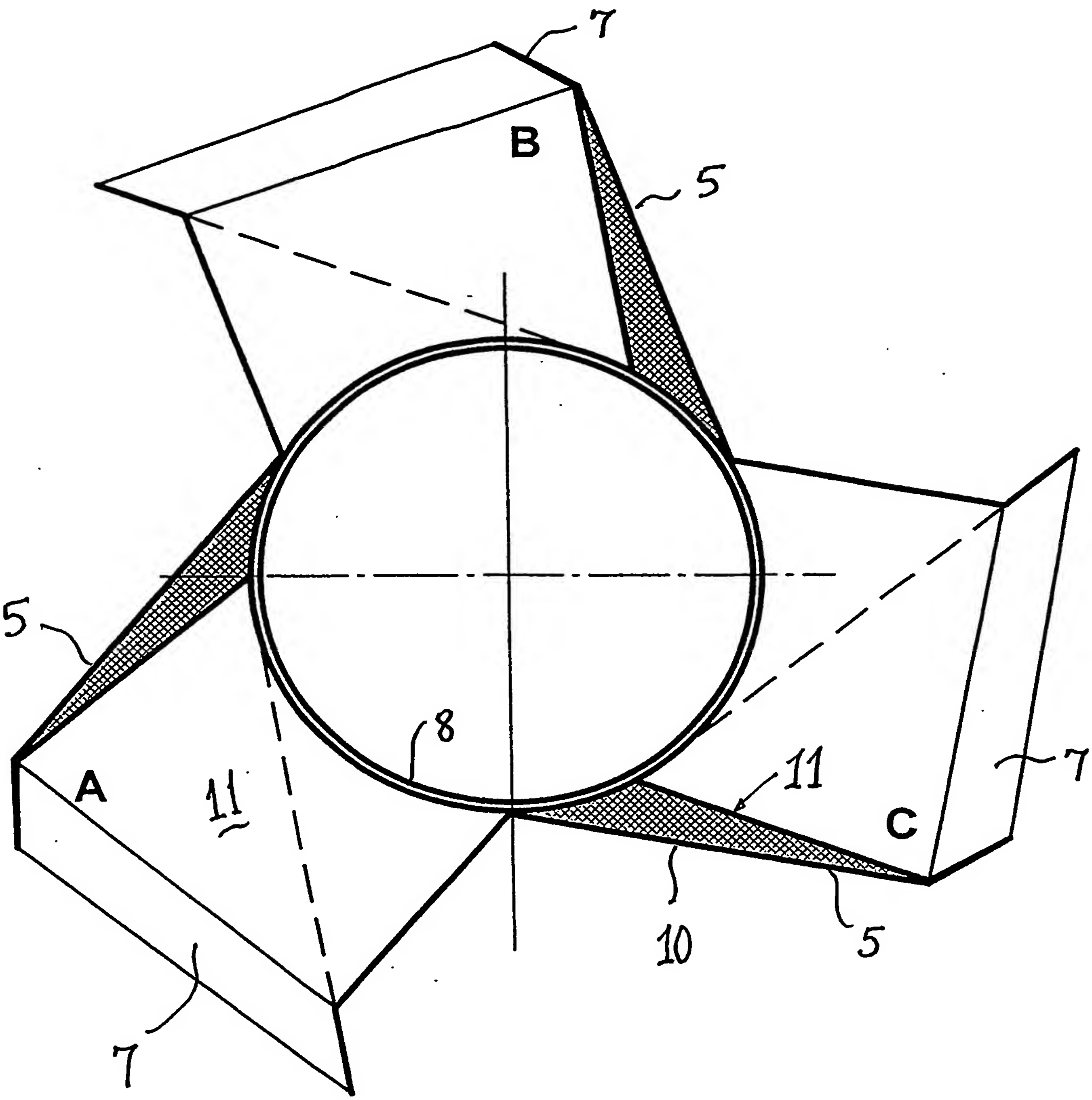


FIG. 2

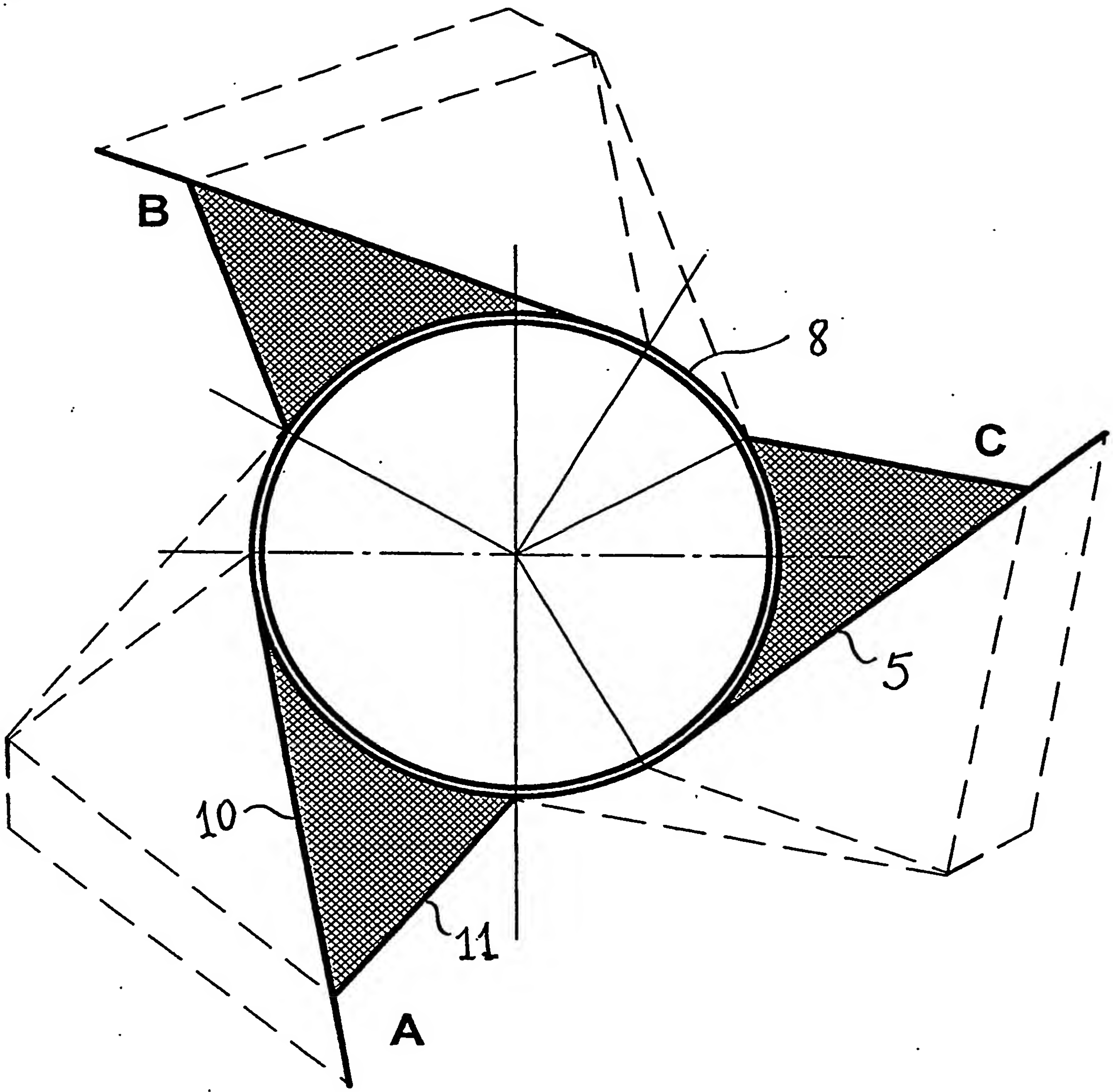


FIG. 3

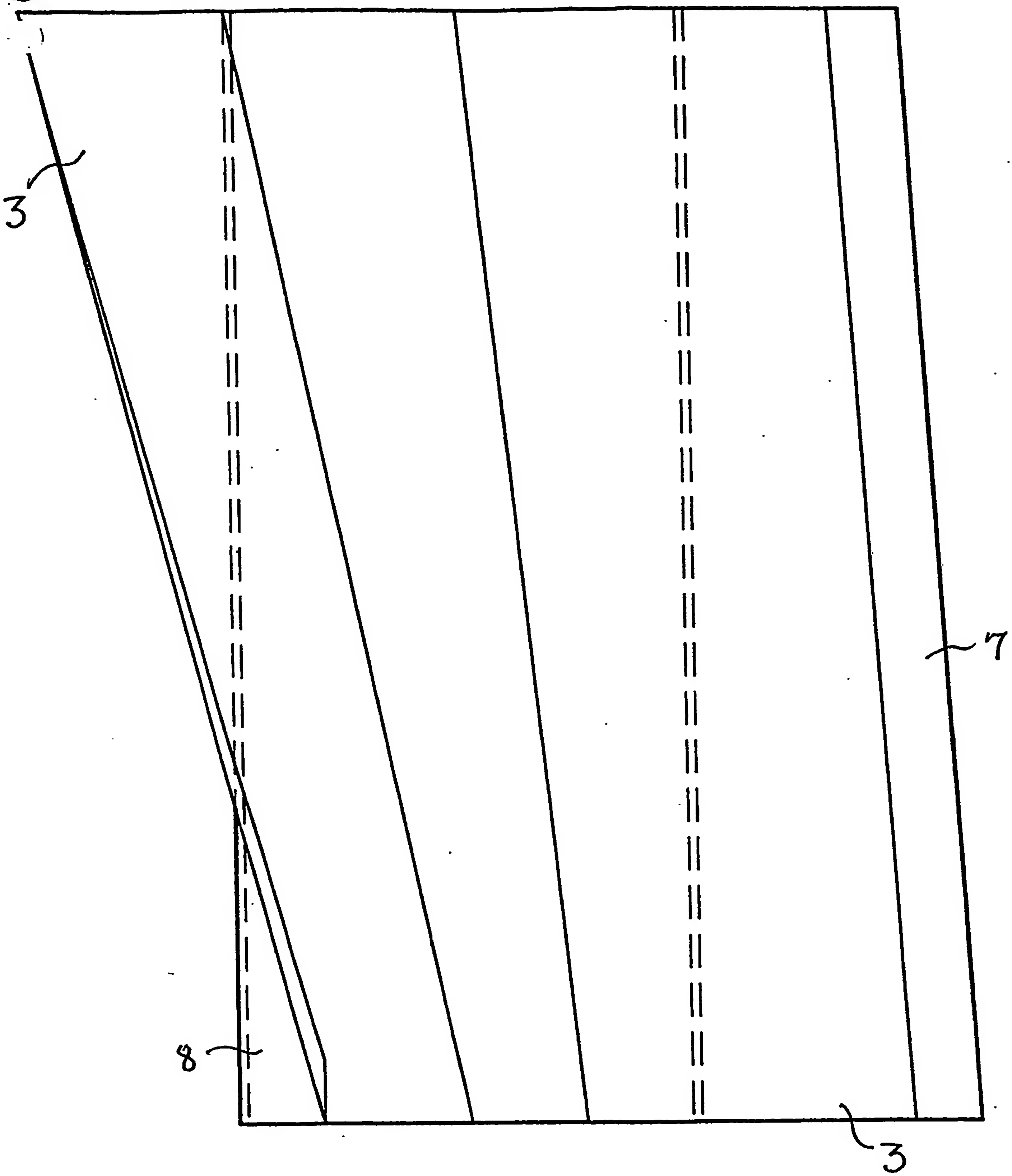


FIG. 4

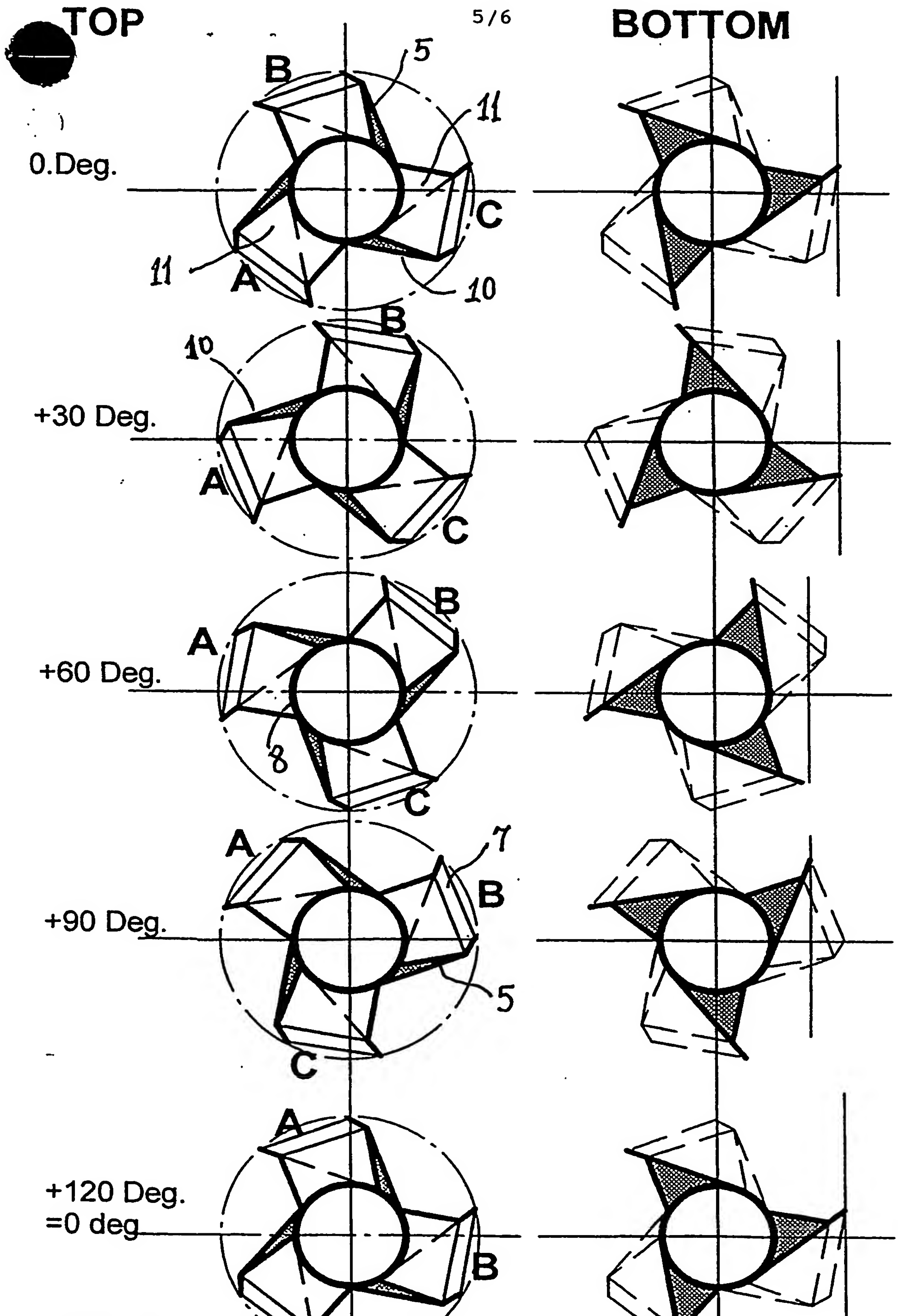


FIG. 5

ROTATION CONTINUOUS CLOCKWISE.

TOP

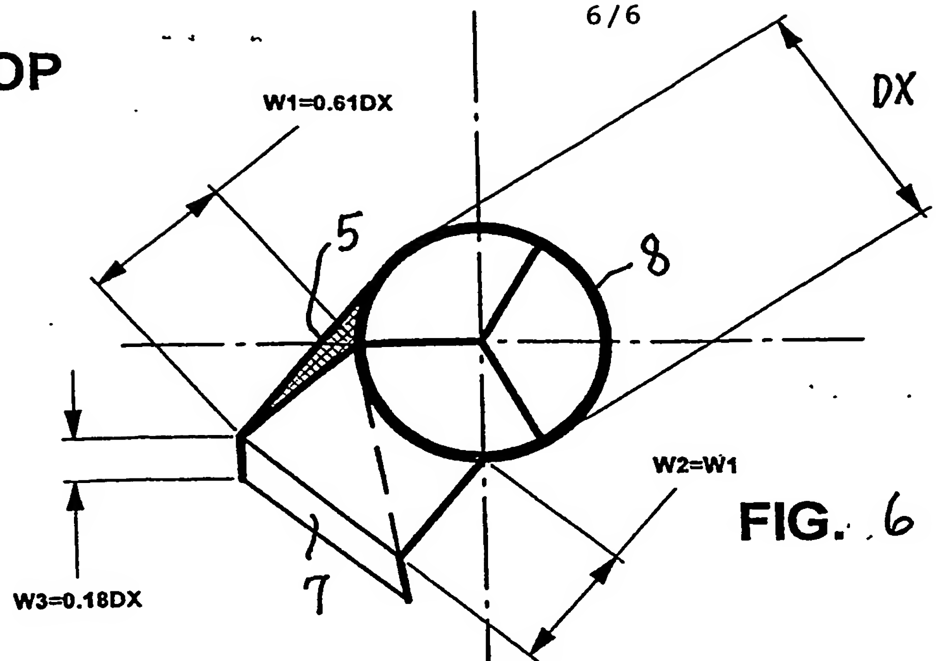


FIG. 6

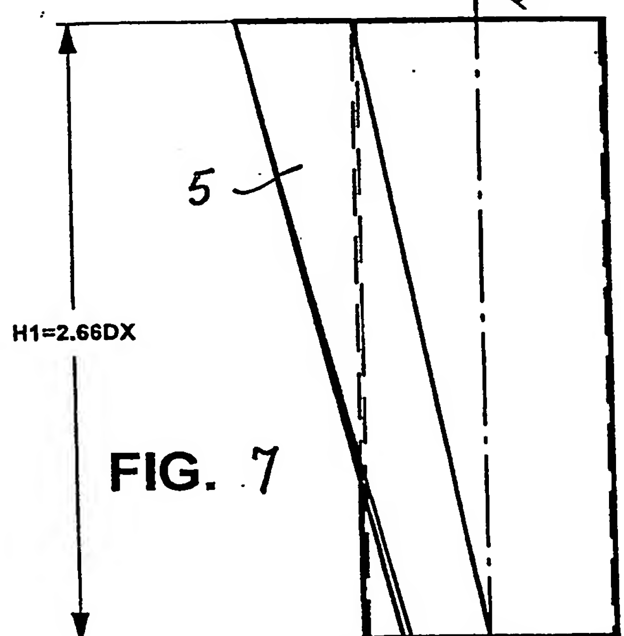


FIG. 7

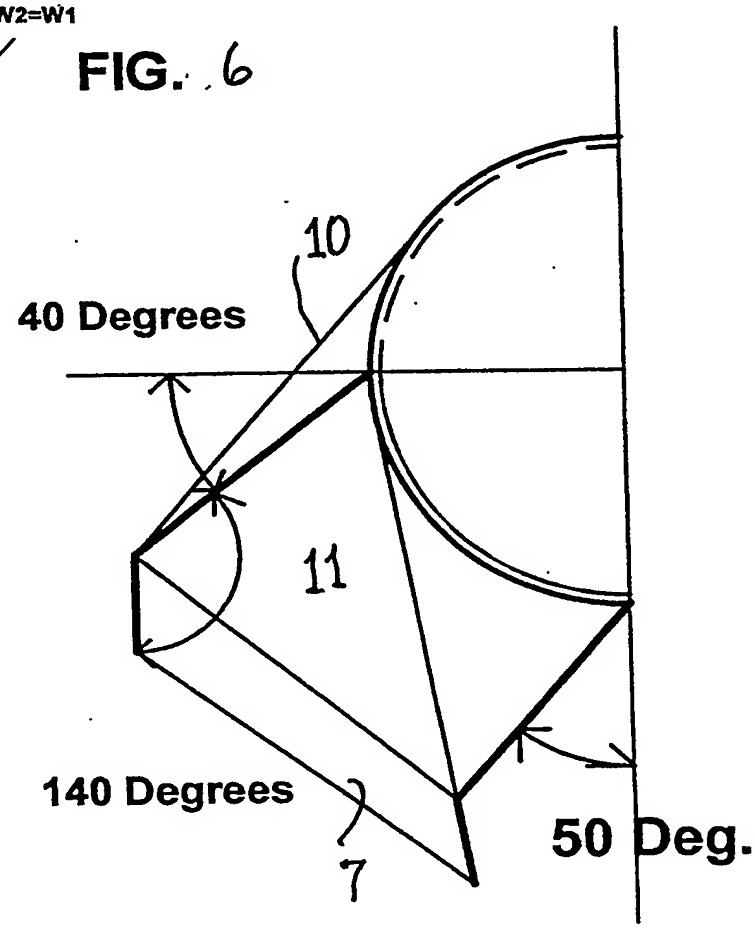
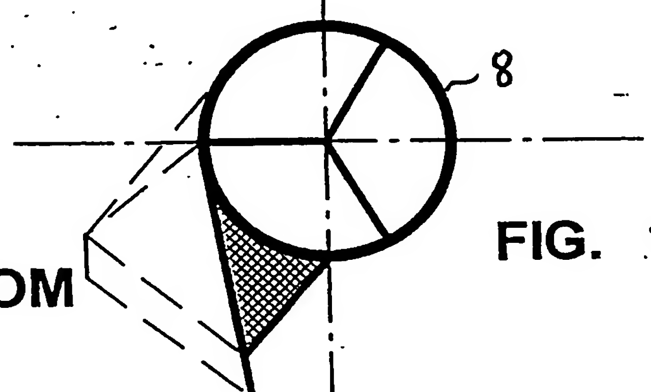


FIG. 9



BOTTOM

FIG. 8